Remarks

Status of Claims

Without prejudice, the claims have been amended to add clarity and to facilitate prosecution. Specifically, Claim 1 has been amended to clarify that the third transmission line is a waveguide. Support for this amendment can be found in Claim 2. Additionally, Claim 1 has been amended to recite that there is a support plate between the first and second transmission lines, and that the support plate defines a borehole between the first and second transmission lines, and a metalized dielectric filter is disposed in said borehole such that a conductive layer in the metalized dielectric filter cooperates with the conductive walls of the borehole to form a waveguide that is smaller than the borehole itself. Support for this amendment can be found in Claim 21 and in the specification page 13, lines 3 through 16. Furthermore, reference to the transducers has been eliminated from Claim 1 and recited instead in new Claim 34. No new matter has been added.

Restriction

Applicants concur that Claim 13 is withdrawn from further prosecution pursuant to 37 C.F.R. §1.42(b) as being drawn to a non-elected invention.

Claim Objections

The Examiner objected to Claim 32 for stating "line" instead of "line's length". In reply, Applicants have amended the claim to read "length of said waveguide" which is essentially in accordance with the Examiner's recommendation.

Prior Art Rejections

The Examiner rejected Claims 1-6, 8, 11, 18 and 23-27 under 35 U.S.C. §102(b) as being anticipated by Cheng, IEEE Article, which was cited in the European Search Report. Additionally, the Examiner rejected Claims 7, 9-10, 12-17, 19-22 and 28-32 under 35 U.S.C. §103(a) as being unpatentable over Cheng in view of the Jain IEEE Article. More specifically, the Examiner acknowledges that Claims 7, 9-10, 12-15, 17, 19-22 and 28-32 recite features which are not disclosed in Cheng, but states that these claim limitations are provided by Jain. In particular, with respect to original Claim 21, the Examiner states that Jain discloses a waveguide having a metalized dielectric filter.

In reply, Applicants respectfully submit that the claims as amended are patentably distinct over the cited prior art.

Claimed Invention

The claimed invention is directed to an easily-manufactured transition. Specifically, the transition comprises first and second transmission lines on parallel planes and a waveguide orthogonal to the first and second transmission lines. Between the first and seconds transmission lines is a support plate. The support plate defines a borehole having conductive walls between the first and second transmission lines. A metalized dielectric filler comprising at least one conductive layer is disposed in the borehole. The combination of the conductive layer and at least a portion of the conductive walls of the borehole form the waveguide.

Since the waveguide is not defined by the borehole, but rather by the combination of the conductive walls of the borehole and a conductive layer of the filler disposed therein, it is smaller than the borehole. This is important because machining a precise waveguide in a support plate, particularly a thick support plate, can be difficult since a waveguide designed for the typical operating frequencies of a transition tends to be very

narrow, for example, 8 mils in the embodiment shown in Fig. 1. It is well known that machining such narrow openings with high precision is difficult and time-consuming, and becomes even more complex as the thickness of the substrate increases. However, by completing the waveguide with filler in the borehole, the borehole can be machined significantly larger than the actual waveguide. Additionally, the tolerance on the borehole may be relaxed since the precision aspect of the waveguide can be borne by the filler, which can be made, for example, using wafer board technology, which is well known, economical, and highly precise. Therefore, the waveguide configuration of the claimed invention facilitates high-volume manufacturing by allowing larger, more loosely-toleranced boreholes to be machined in the substrate for use as waveguides.

Jain

Jain discloses a microstrip-to-rectangular waveguide mode transformer that can implemented in PCB technology. The transformer has a wide simulated frequency response, which allows it to be used for many applications. This paper also recognizes that with this transformer facilitates manufacturing by easing tolerances. It states, for example, that circuitry may be printed on top of a substrate for mm-wave application "even when line lithography may not be very well controlled." Additionally, the paper suggests that manufacturing may be further facilitated by replacing the continuous walls of the waveguide portion of the transformer with via-holes mimicking the continuous ground wall. The transformer disclosed herein is similar in many respects to the transducer described in the present application.

Cheng

Cheng describes a method to transfer RF energy from microstrip to a vertical waveguide and then to the microstrip again. Specifically, Cheng relies on a microstrip-to-slot transition to transfer the energy to the waveguide (the slots are clearly visible on

the microstrip ground planes). This method is well known in literature. Indeed, it is even addressed in the background of the application as follows:

> There are a number of reported developments for transferring a signal from one transverse plane to another one. For example, the microstrip-to-slot transition along with its variants which use a vertical waveguide section is one of the more commonly used techniques for this purpose. This approach, however, has a number of disadvantages. First, this transition relies on the resonance phenomenon to achieve a good match. Therefore it is particularly susceptible to geometry variations in the transition. Additionally, since the transition has no back short, it suffers from relatively high insertion loss due to radiation. This is especially important because the spurious radiations that may occur in such a transition may increase the cross talk or affect the antenna pattern in a mm-wave system.

(Appln. p. 2, ll. 10-18). The susceptibility to the geometry variation in the transition mentioned above results in a transition having very narrow bandwidth due to the reliance of the resonance phenomena of the slot.

Argument

The Combination Of Cheng And Jain Fails To Disclose A Transition In Which The Waveguide Comprises A Combination Of A Borehole With Conductive Walls And A Dielectric Filler Having A Conductive Layer Which Is Disposed In Said Borehole To Form A Waveguide That Is Smaller Than The Borehole

Neither the reference, alone or in combination, discloses a transition in which the waveguide linking the transmission lines on different planes comprises a borehole with conductive walls and a dielectric filler with a conductive wall disposed in the borehole such that the conductive walls of the borehole and the conductive layer of the dielectric filler form a waveguide which is more narrow than the borehole itself. It is well established in patent law that, to support a *prima facie* showing of obviousness, each and

every element of the claimed invention must be taught or suggested by the combination of the references.

Here, an important aspect of the claimed invention is a waveguide which is formed by the combination of the conductive walls of the borehole and the conductive layer of the dielectric filler in the borehole. This is an important feature of the claimed invention as it facilitates manufacturing. As mentioned above, a relatively-large, loosely-toleranced borehole can be readily machined into a support platform, and then an easily-manufactured, high-precision dielectric filler can be dropped into the borehole to complete the waveguide. This avoids the need to machine a very narrow, high-precision waveguide in a substrate which can be very difficult, especially as the substrate increases in thickness.

Neither Cheng nor Jain discloses such a configuration. Cheng discloses an ordinary slot type waveguide transition as mentioned above. As already recognized by the examiner (with respect to original claim 21), this reference does not teach or suggest the waveguide configuration of the claimed invention. Although Jain discloses a transducer which is similar to that used in the transition of the claimed invention, it does not disclose forming a waveguide by the combination of a borehole and a metalized dielectric. This is not surprising since the reference does not discuss, in any detail, the waveguide to which the transformer is attached. Since the waveguide is really not the subject of the disclosure, it is difficult to image the motivation for modifying the disclosed transformer to include the waveguide configuration of the claimed invention. Indeed, any modification would have to be the result of hindsight rather than motivation found within the references themselves. Since the cited references, alone or in combination, fail to disclose each and every element of the claimed invention, they cannot support a *prima facie* showing of obviousness. Accordingly, the rejection should be withdrawn and the claims allowed.

In light of the above remarks, an early and favorable response is earnestly requested.

Respectfully submitted,

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